

To: DOCUMENTATION CENTER OF TMC TECHNICAL ADMINISTRATION DIV.

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Dist. in affiliates	TMS: PQSS Mr. Zellers, Mr. Aoki, Mr. Morino, Mr. Yamamoto	Report Date	[AT]
TITLE	EA06-020 Sienna Power Liftgate: Final Response to NHTSA Information Request Letter	Originated: C. Santucci	
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Summary:

On May 16, TMA held a demonstration of the power liftgate of the Toyota Sienna for NHTSA. Two vehicles were brought to NHTSA's office in Washington and used for the demonstration. TMC-CQE Mr. Kato and TMC-PKB Mr. Shigeoka prepared prototype liftgate struts to be used in the demo. They attended the demonstration, along with Mr. Morino, Mr. Yamamoto, and Mr. Forsht of TMS-PQSS who prepared the vehicles and installed the struts. In attendance from NHTSA were the Investigator (M. Lee), the Division Chief (T. Cooper), and the Office Director (K. DeMeter) from the Office of Defects Investigation (ODI). Three members of NHTSA Chief Counsel attended (L. Guerri, O. Matheke, D. Case), and a test engineer from the NHTSA's Vehicle Research and Testing Center (VRTC - R. Esser). There was also a Human Factors Engineer present for the demo.

TMA gave the presentation, which consisted of an overview of the strut design and the design changes that had been made to date. The presentation then went into the system design, the components, the operating logic, and the jam and pinch protection. A copy of the presentation is attached to this report.

During the presentation, TMA demonstrated the operation of the liftgate, the jam protection logic, and the pinch protection sensors using the vehicles. Afterwards, combinations of the prototype struts were installed. This was done to demonstrate the effect that a progressive failure of the liftgate support struts has on the system. As mentioned in our IR response, the failure of the liftgate support struts is gradual, and owners can notice the liftgate struts are failing due to a slower than normal opening speed.

The first combination was setup to simulate a condition where one strut can only provide 60% of its normal operating force. Around this point, the power liftgate, when opened, cannot fully be supported by the struts. In this condition, the liftgate will descend slowly, below the threshold required to activate power closure of the liftgate. It is a difficult condition to simulate, as ambient temperature and wind conditions can affect the closure. However, this mode was demonstrated perfectly. The liftgate was driven open by the motor to almost the fully open position. When it released, the liftgate slowly drifted close. At about halfway closed, the liftgate completely stopped. Then, it slowly began closing again. As it closed, it gained speed. When it finally closed, it was at a speed where it could just overcome the power latching mechanism (the Sienna has a power closing system for latching shut) and was, for lack of a better description, a "soft slam shut." Interestingly enough, there was some astonished NHTSA faces. Some had never seen it close in such a manner, and immediately commented how forceful it seemed. However, it is important to understand TMA's surprise at their reaction, as from the author's perspective, the closing was not very forceful. More importantly, TMA believes that NHTSA's reaction is clear indication that NHTSA strongly needed this demonstration for their own educational purposes.

Enclosures: Technical Presentation

For example, as noted above, a Test Engineer from VRTC was present. As the presentation was going through jam and pinch protection, this engineer was very curious, asking specific questions, and wanting to try the jamming modes himself. Afterwards, he commented that the demonstration vehicle was not behaving the as was his own test vehicle. This is interesting, because NHTSA has never commented to TMA that the types of injuries they have heard about in their complaints have been related to jam protection. Furthermore, jam protection injuries could occur regardless of whether or not the support struts degrade.

It also presents a problem, because it is clear that NHTSA does not understand the issue clearly. Toyota has prepared and submitted many documents explaining the operation of the liftgate and the failure mode of the liftgate struts. It is possible that NHTSA either did not understand the documents, or has not had time to properly review them. But, it is clear that the demonstration was the first time many in the group had ever seen the Sienna power liftgate in operation, just based on their reactions. It is also clear that NHTSA has begun a testing program wherein they are not testing the correct aspects of the investigation. Therefore, they will not be able to answer the question of whether this issue is a safety problem or not by testing. (This is not the first time NHTSA has run incorrect test programs – The runflat tire inflation pressure testing was all run at internal inflation pressures well above the Toyota-supplied minimum thresholds).

However, TMA was able to tailor the demonstration (after this realization) to better educate NHTSA. So, immediately after the “soft slam” of the liftgate, TMA demonstrated the opening of the liftgates on the two vehicles simultaneously. One vehicle had normal struts, and the other had the degraded struts. The new struts raised the liftgate much quicker (~33% faster) than the degraded struts. Some agreed that it was noticeable, others did not. Regardless, though, they began to understand the issue from Toyota’s perspective. Next, a set of struts simulating one strut at 30% effectiveness was installed on one of the vehicles. This combination demonstrated the system initiating power closure of the liftgate because the struts can not support the weight and the liftgate drops quickly after release.

After this demonstration, there were some further discussions with ODI. The ODI division chief mentioned that consumers are not aware of the failure, and don’t expect a failure to occur on vehicles with low mileage. TMA explained that the issue is not mileage dependant, but rather dependant on opening and closing cycles and exacerbated by side loading on the strut (liftgate twist).

It is very important now that Toyota begin an effort to properly educate NHTSA on this issue. It is obvious that NHTSA does not understand the injury mechanisms described in the complaints. They do not know that other power liftgates are designed similarly and that these peer vehicles also behave the same with failed struts. TMA even learned that the ODI Office Director was not aware of the Ford recall in which Ford reprogrammed their liftgate to act like Toyota’s, which was a major factor in our IR response.

Summary of Toyota’s position (as was demonstrated to NHTSA):

- The failure mode of the liftgate struts is a gradual degradation of opening and closing performance of the system
- This gradual degradation of performance provides appropriate warning of the malfunction and is easily noticeable to the operator
- Liftgate support struts are a wear item, and some of them may not last the life of the vehicle
- In the event a power liftgate is commanded to open and the struts cannot support its weight, initiating power closure is the most appropriate failsafe function in order to prevent a dangerous freefall condition
- Power closure is accompanied by both visual (hazard lamp flash) and auditory warnings
- Jam and pinch protection promote safety in the event an operator is surprised by a closing liftgate
- Similar functionality is used by other manufacturers to promote safety as well

TMA recommends preparing a peer analysis of power liftgate-equipped vehicles and providing this information to NHTSA. Including a breakdown of the injury type, body location, and severity as found in the complaints would help NHTSA understand the issue better. Finally, developing a methodology to properly test the liftgate closing speed and force would also be useful in a comparative test program.